

## Predicting Sleep Quality Based on Mindfulness among the Patients who Suffer from Irritable Bowel Syndrome (IBS): Investigating the Mediating Role of Self-Regulation and Rumination

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### Abstract

**Background and Objective:** Some studies have investigated the quality of sleep among patients with irritable bowel syndrome (IBS); however, they are not comprehensive. The current study was conducted to predict quality of sleep among patients with IBS based on mindfulness, the mediating role of self-regulation, and rumination.

**Materials and Methods:** This was a cross-sectional study in form of structural equation modeling (SEM). The samples included 231 patients with IBS, and the measures were Mindfulness, Self-regulation, Rumination, and Pittsburgh Sleep Quality Index (PSQI) scales. In addition, the SPSS and R software were used to analyze data.

**Results:** Mindfulness, along with the mediating role of self-regulation and rumination could predict sleep quality among patients with IBS ( $P < 0.01$ ), and the fit indices indicated the model fit.

**Conclusion:** Mindfulness, rumination, and self-regulation had an important role in sleep problems among patients with IBS.

**Keywords:** Sleep quality; Irritable bowel syndrome; Mindfulness; Emotions

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### Introduction

Irritable bowel syndrome (IBS) is a chronic functional bowel disorder that is defined as abdominal pains that occur with recurrent constipation and diarrhea (1). This disorder is usually more prevalent among women compared to men. Studies have reported that about 50% of patients with IBS have poor sleep quality and this issue intensifies their illness symptoms (2, 3). The initial symptoms of IBS can have destructive effects on sleep quality. Recent evidence has revealed that the destructive pattern of sleep can increase

visceral sensitivity and gastrointestinal symptoms among these patients (4). Therefore, it is highly influential to identify potential factors of sleep quality in these patients.

One of the factors that determine poor sleep quality is the disability in managing emotions, such as stress, anxiety, and depression. Correspondingly, the disability in managing emotions intensifies these emotions on the one hand and intensifies the sleep issues on the other hand (5). Studies have shown that about 60% of people who have emotional problems have poor sleep quality at the same time. On the contrary, more than half of patients with IBS suffer from emotional problems simultaneously. This issue indicates the impact of emotional problems on sleep quality

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among these patients (6). Another crucial variable that is related to the quality of sleep is rumination. Rumination with the patient's concentration on a negative event affects them to experience emotional and cognitive arousal before sleep, and this retains the problems of poor sleep quality (7). Rumination is actually against flexibility which usually occurs with effective emotion management and better sleep quality (8).

On the other hand, in line with recent studies, one of the most crucial components that are related to both sleep quality and emotional problems is mindfulness (9). Thus, most therapists use mindfulness techniques to improve sleep quality among patients (10). Mindfulness means paying attention to the present, in a special way, without any judgment. It keeps the patient's attention on the present by providing the practices, and it avoids focusing on the past and future which are the main sources of emotional problems (11). Ultimately, the quality of the patient's sleep is improved by improving their perception of destructive emotions (10). Studies have highlighted that people who cannot use mindfulness skills experience both emotional problems and poor quality of sleep compared to those who have this ability. Moreover, studies have reported that mindfulness happens with less rumination and more psychological flexibility. Therefore, mindful people can usually change their focus easily and do not suffer from rumination (12).

Some studies have been conducted about the relationship between mindfulness, emotional problems, and rumination with sleep quality. However, the researchers of the current study have not found any consistent research to investigate these constituents in the form of a proposed model. Besides, the previous studies were carried out in isolated and scattered ways. Considering the high prevalence of emotional problems and poor sleep quality among patients with IBS, limited studies have designed a comprehensive model so far to predict the sleep quality among these patients and recognize the underlying factors for their disorder. Thus, the present study aimed to predict sleep quality among patients with IBS based on mindfulness, the mediating role of rumination, and self-regulation.

## Materials and Methods

This was a cross-sectional study in the form of structural equation modeling (SEM), and it was

conducted in 2021-2022. SEM is a perspective in which hypothesized patterns of direct and indirect relationships are examined among a set of observable and latent variables. The samples of this research included patients who suffered from IBS, were visited by internal medicine specialists in Tehran, Iran (Shariati, Imam Khomeini, and Sina hospitals), and received the IBS diagnosis from these specialists. The questionnaires were given to the patients and were filled out after coordinating with the relevant sections and filling out the informed consent form. The number of patients was 242, among which 11 individuals were removed from the analysis due to incomplete completion of the questionnaires. The inclusion criteria were diagnosis of IBS by an internal medicine specialist, diagnosis of no acute gastrointestinal disease except IBS simultaneously, and informed consent to participate in the study. The other inclusion criteria included the ability to read and write, and the absence of suffering from mental disorders that debilitate realism, such as bipolar disorder and schizophrenia. Exclusion criteria consisted of suffering from acute physical diseases [cancer, diabetes, acquired immunodeficiency syndrome (AIDS), cardiovascular, etc.], having drug abuse, and filling out the questionnaires incompletely. Moreover, anxiety, depression, and sleep disorders were the other exclusion criteria that influenced sleep quality.

## Instruments

**Self-Regulation Questionnaire:** This questionnaire was developed by Hoffman and Kashdan (2010) that included 20 questions. The answers were in the form of a five-point Likert scale, in which the scores ranged from 20 to 100. Furthermore, it had three components or subscales of stealth, adaptability, and tolerance with 8, 7, and 5 questions, respectively. The results of psychometric characteristics revealed that this questionnaire reported appropriate reliability, calculated by Cronbach's alpha (0.81). This questionnaire was standardized in Iran, and its convergent validity was reported as 0.47 (13). The convergent validity for the subscales of stealth, compatibility, and tolerance was 0.70, 0.75, and 0.50, respectively. In addition, Cronbach's alpha equaled 0.82 (14).

**Mindfulness Questionnaire:** This questionnaire was a 39-item scale (2006). The answers were scored ranging from never (= 1) to always (= 5) with the maximum score of 195 and minimum score of 39. The value of Cronbach's alpha

was 0.93 for original scale, and convergent validity was reported as 0.53 (15). This questionnaire was standardized by Sajjadian in Iran with a divergent validity of -0.42 and reliability of 0.81, using Cronbach's alpha (16).

**Pittsburgh Sleep Quality Index (PSQI):** This questionnaire assessed the sleep quality of people during the recent four weeks. It included seven subscales and a general score, ranging from 0 to 21. A score of 5 or less than 5 indicated the absence of sleep problems, and a score greater than 5 showed a poor quality of sleep. The reliability of this questionnaire was analyzed, using Cronbach's alpha in the original study, and its value (86.5) indicated appropriate reliability. The diagnostic sensitivity was 89.6% and specificity was 86.5% (17). This questionnaire has been standardized by Farrahi Moghaddam et al. in Iran, and its results revealed convergent validity of 0.88 and reliability of 0.84, running Cronbach's alpha (18).

**Rumination Scale:** This scale was designed by Ghorbani et al. (2008), and it had 20 items with two subscales of rumination and reflection. The scoring of the questionnaire was based on a five-point Likert scale. The reliability of the questionnaire in the mentioned research was obtained by Cronbach's alpha greater than 0.80; besides, its convergent validity was reported as 0.65 (19).

Descriptive statistical analysis was used to assess the demographic information, and Pearson correlation method was run to assess the relationship among variables. The proposed model was investigated, using SEM, and all the analyses were conducted via SPSS (version 25, IBM Corporation, Armonk, NY, USA) and R software in this study. Among 242 participants, 11 patients were removed from the analysis due to incomplete

completion of the questionnaires, and the data were analyzed for 231 patients.

### Results

The demographic information of the participants reported their average age as 34.45 years. 122 of these participants were women, and 109 of them were men. Moreover, in terms of education, 112 of them had a diploma or undergraduate degree, 67 people were Bachelor of Arts (B.A.) students, 35 of them were Master of Arts (M.A.) students, and 17 of them were Philosophiae Doctor (Ph.D.) students. Among these 231 participants, 168 of them were married, 46 of them were single, and 17 of them were divorced. Table 1 reports the elongation and skewness for all the variables between -2 to 2 that indicate the data normality. The results of correlation revealed a significant relationship among the majority of the variables in terms of correlation. The correlation was reported from 0.07 to 0.79. Therefore, the requirement of investigating the mediating role of self-regulation and rumination was met about mindfulness and sleep quality, considering the significant relationship among the variables.

Table 2 shows the indices of model fit. Goodness of fit index (GFI) equaled 0.95 which indicates a good model fit because the index fit was greater than 0.90. Further, considering this table, investigating the model fit indices, and comparing them to the acceptable indices indicated the model confirmation.

Moreover, table 3 reports the coefficients of the direct path of the variables. As the results reveal, the direct effect of mindfulness on self-regulation behavior equaled 0.37, and it equaled 0.55 on rumination, which was statistically significant. Figure 1 shows the relationships among the variables.

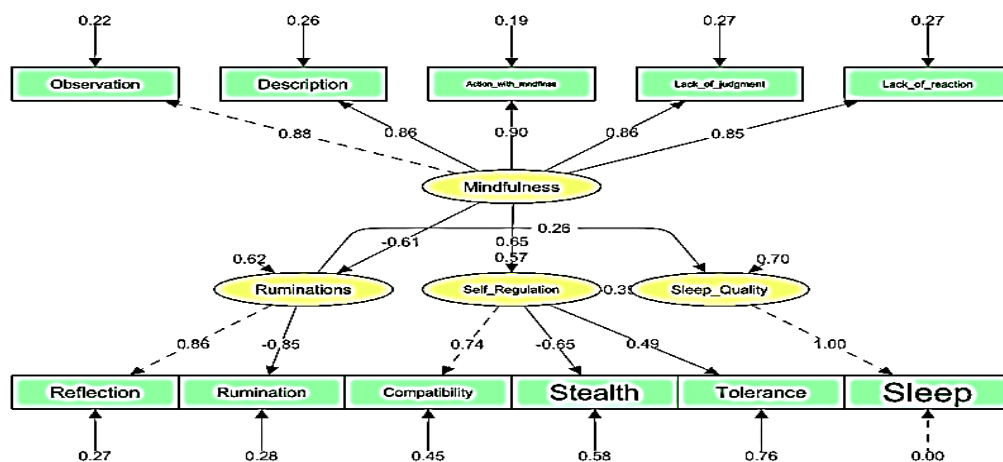


Figure 1. Predicting sleep quality based on the mediating role of self-regulation and rumination

**Table 1.** Kurtosis, skewness, and correlation among variables

	Mindfulness observation	Mindfulness description	Mindfulness action	Mindfulness judgment	Mindfulness response	Rumination	Reflection	Compatibility	Stealth	Tolerance	Sleep quality	Skewness	Kurtosis
Mindfulness observation	1	0.76**	0.79**	0.73**	0.76**	-0.43**	0.42**	0.47**	-0.35**	0.27**	-0.40**	0.10	0.05
Mindfulness description	0.76**	1	0.77**	0.74**	0.73**	-0.44**	0.46**	0.44**	0.34**	0.16*	-0.39**	-0.09	0.55
Mindfulness action	0.79**	0.77**	1	0.78**	0.76**	-0.46	0.48	0.44**	-0.37**	0.22**	0.45**	0.06	0.76
Mindfulness judgment	0.73**	0.74**	0.78**	1	0.72**	-0.44**	0.45**	0.45**	-0.34**	0.27**	-0.38**	0.05	0.38
Mindfulness response	0.76**	0.73**	0.76**	0.72**	1	-0.46**	0.38**	0.38**	-0.33**	0.18**	-0.46**	0.05	0.44
Rumination	-0.43**	-0.44**	-0.46**	-0.44**	-0.46**	1	-0.72**	-0.24**	0.18**	-0.07	0.35**	-0.03	0.23
Reflection	0.42**	0.46**	0.48**	0.45**	0.38**	-0.72**	1	0.24**	-0.20**	0.17**	-0.31**	-0.05	0.32
Compatibility	0.47**	0.44**	0.44**	0.45**	0.38**	-0.24**	0.24**	1	-0.48**	0.38**	-0.29**	-0.04	0.82
Stealth	-0.35**	0.34**	-0.37**	-0.34**	-0.33**	0.18**	-0.20**	-0.48**	1	-0.33**	0.32**	-0.01	0.23
Tolerance	0.27**	0.16*	0.22**	0.27**	0.18**	-0.07	0.17**	0.38**	-0.33**	1	-0.26**	0.20	-0.23
Sleep quality	-0.40**	-0.39**	0.45**	-0.38**	-0.46**	0.35**	-0.31**	-0.29**	0.32**	-0.26**	1	0.22	0.37

\* Stands for significant with  $P < 0.01$ \*\* Stands for significant with  $P < 0.05$ **Table 2.** Investigating the indices of model fit

Indices	DF	AGFI	GFI	CFI	IFI	NFI	RMSEA
Model value	41	0.94	0.96	0.99	0.99	0.98	0.02
Acceptable value	+	More than 0.90	More than 0.90	More than 0.90	More than 0.90	More than 0.90	Less than 0.05
Status	Good	Good	Good	Good	Good	Good	Good

DF: Degree of freedom; GFI: Goodness of fit index; AGFI: Adjusted goodness of fit index; CFI: Comparative fit index; IFI: Incremental fit index; NFI: Normed fit index; RMSEA: Root mean square error of approximation

**Table 3.** The structural model of the directions and standardized coefficient of the direct path of variables in the final model

Direction		Standardized beta	P-value
Mindfulness	Rumination	-0.55	< 0.01
Mindfulness	Self-regulation	0.37	< 0.01
Rumination	Sleep quality	0.17	< 0.01
Self-regulation	Sleep quality	-0.42	< 0.01

The results showed the significant effect of the mediating role of rumination and self-regulation, concerning mindfulness and sleep quality. Table 4 shows the results of the mediating effect of rumination and self-regulation.

### Discussion

The current study aimed to predict sleep quality based on mindfulness with the mediating role of self-regulation and rumination among patients with IBS. The results of this study are in congruence with those studies in which the findings revealed that mindfulness and self-regulation could predict sleep quality among various populations (9, 20, 21). To explain these findings, it can be claimed that self-regulation skills are actually among the main sources of determining sleep quality. Therefore, tensions and emotional problems before sleep disturb the natural process of falling asleep. On the other hand, mindfulness skills reduce dysfunctional emotions by presenting relaxation exercises and avoiding stressful thoughts. Besides, these skills improve sleep quality, and their absence leads to emotion management which is one of the main sleep problems (20). In addition, one of the influential sources of disturbing sleep procedures is paying attention to physical symptoms before sleep and the disability in regulating them. This issue causes patients to have judgmental attention about their physical reactions and see them as symptoms of attention or anxiety. This leads to creating a cycle of exacerbating emotional and physical symptoms. However, in mindfulness, people nurture non-judgmental observation skills; thus, they consider these symptoms as signs of life that occur naturally and not as a threat. Moreover, another significant dimension of self-regulation is the failure of

individuals to cope with some emotions or refuse them. This causes that emotion to get exacerbated among patients and ultimately, disturbs their sleep. Nevertheless, in mindfulness, the individuals do not change or remove a particular emotion, but they accept various emotions and improve their tolerance to encounter different emotions (22).

The other finding of this study was predicting sleep quality through mindfulness and the mediating role of rumination. This finding is in line with those studies that indicated poor natural procedures for sleep caused by rumination (7, 23). Rumination, along with individuals' focus on emotional symptoms, thoughts, and negative events and exaggerating them, results in emotional arousal and ultimately, sleep procedure disturbance. This study revealed that mindfulness had a positive relationship with thought on one hand, and a negative relationship with rumination on the other hand. Mindfulness creates the ability in individuals to efficiently change their cognitive evaluation of reality. Correspondingly, it causes people to change their attention from undesirable thoughts and analyses to pleasant and positive thoughts, using various exercises (24, 25). In addition, another function of mindfulness is creating an individual's separation from thoughts. Patients who suffer from negative rumination, usually think about negative thoughts in a chain manner. These negative thoughts result in emotional arousal and prevent the natural formation of sleep pathways. However, mindfulness and its exercises separate people from their thoughts, so that they only watch them, and do not get united with them. Therefore, the continuity of negative rumination is reduced.

Despite the above findings, the current study has some limitations. First, this study was conducted on patients with IBS, and it cannot be generalized to other populations. Second, most patients with IBS have sleep problems; however, most of this study participants did not have a primary sleep problem. Thus, care should be taken into account in terms of generalizing these results to patients who suffer from a primary sleep problem. Third, this research has used self-report measures; consequently, it is recommended that more accurate measures be used in future studies.

**Table 4.** The indirect effect of the variables

Model direction				Standardized beta	P-value	
Mindfulness	→	Self-regulation	→	Sleep quality	-0.09	< 0.01
Mindfulness	→	Rumination	→	Sleep quality	-0.15	< 0.01

## Conclusion

Low mindfulness, rumination, and self-regulation lead to sleep problems in patients with IBS.

## Conflict of Interests

Authors have no conflict of interests.

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